Amendments to the Specificati n

Please replace the paragraph beginning on page 13 line 24 with the following:

The programmed holographic structure, written on or within the planar substrate, diffracts the signals incident from one or more input ports to one or more output ports while simultaneously applying a programmed spectral ~~and/or temporal~~ transfer function. Fig. 8 shows an embodiment 800 of a planar programmed holographic processor, 802 with a single input port 804 and a single output port 806. An input optical signal ~~spatial wavefront~~ expands from the fiber or waveguide input port 804 as shown. As it propagates, it is diffracted backwards and ~~the output spatial wavefront is~~ focused onto the output port 806 ~~, so that each portion of the output spatial wavefront contributes to a plurality of portions of the output temporal waveform, and each portion of the output temporal waveform includes contributions from a plurality of portions of the input spatial wavefront~~. The back diffraction process acts further to apply the design spectral transfer function. The spacing between the input and output ports, d, is conveniently made as small as possible, with a ~~typcial~~ typical separation of between about 25 to about 5000 microns. The output port 806 and the input port 804 do not have to be close, but placing them thusly provides for the highest spectral resolution possible for a fixed device length L. For a device length of L, the spectral resolution available with closely spaced input and output ports is roughly $v_s/2L$, where v_s is the speed of light in the utilized z-modes of the holographic substrate. Spectral resolution is degraded by refractive index or thickness variations of the holographic substrate, unless compensated for in the design of the programmed holographic structure. Actual resolution from a device possessing uncompensated refractive index or thickness variations can be

estimated by replacing the actual device size L in the formula above with an effective length given by the distance over which actual optical signals within the programmed holographic structure remain coherent with a reference wave that propagates at constant speed. In Fig. 9A a planar programmed holographic structure having an input 902 and multiple outputs 904 is shown. Each of a plurality of signals transmitted from an input 902 (there may be one or more than one signal sent to each output) to outputs 904 experiences a different transfer function. The configuration shown in Fig. 9A may serve as a wavelength-based or temporal-waveform-based demultiplexer; the configuration shown in Fig. 9B, may serve as a multiplexer having inputs 922 and an output 920.

Please replace the paragraph beginning on page 15 line 25 with the following:

In Figure 12, a programmed holographic device 1200 is shown, configured as an optical waveform cross-correlator. A holographic substrate 1202 is mounted to a support slab using an attachment strip 1204. An input fiber 1206 guides an input signal ~~temporal waveform~~ $E_i(t)$, having Fourier spectrum $E_i(\omega)$, into the holographic substrate ~~with an input spatial wavefront~~ to interact with the programmed holographic structure contained therein. An output signal ~~temporal waveform~~ 1212, $E_{out}(t)$ produced by back diffraction from the programmed holographic structure within or on the substrate~~, each portion of the output spatial wavefront contributing to a plurality of portions of the output temporal waveform, and each portion of the output temporal waveform including contributions from a plurality of portions of the input spatial wavefront~~, is fed into an output fiber 1208. The holographic structure 1200 is programmed so that its spectral transfer function is $E_d^*(\omega)$, where $E_d(\omega)$ is the Fourier transform of a design matching input signal $E_d(t)$.

The output signal whose electric field is proportional to the integral, over the frequency ω, of the product $E_d*(\omega)$, • $E_i(\omega)$, represents the cross correlation of $E_i(t)$, where $E_d(t)$.